

Seven new species of *Haemodorum* (Haemodoraceae) from the Kimberley region of Western Australia

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Abstract

Barrett, R.L., Hopper, S.D., Macfarlane, T.D. and Barrett, M.D. Seven new species of *Haemodorum* (Haemodoraceae) from the Kimberley region of Western Australia. *Nuytsia* 26: 111–125 (2015). *Haemodorum basalticum* R.L.Barrett, Hopper & T.Macfarlane, *H. capitatum* R.L.Barrett & Hopper, *H. condensatum* Hopper & R.L.Barrett, *H. griseofuscum* R.L.Barrett, M.D.Barrett & Hopper, *H. interrex* R.L.Barrett & M.D.Barrett, *H. macfarlanei* R.L.Barrett and *H. thedae* R.L.Barrett are described as new species. *Haemodorum basalticum* and *H. macfarlanei* are restricted to the Mitchell Plateau, *H. capitatum* is restricted to pindan sands in the Dampier Botanical District, *H. condensatum* is known from a small area in the remote Prince Regent National Park, *H. griseofuscum* is only known from a single location on Doongan Station in Western Australia, although possibly also occurs in the Northern Territory, *H. interrex* is restricted to the area around the headwaters of the Prince Regent River, and *H. thedae* is only known from Theda Station. A key is presented to all species known to occur in the Kimberley region, and *H. subvirens* F.Muell. and *H. coccineum* R.Br. are newly recorded for the region.

Introduction

Seven new species of *Haemodorum* Sm. from northern Australia are described for the Kimberley region of Western Australia. *Haemodorum basalticum* R.L.Barrett, Hopper & T.Macfarlane was recognised as *H. sp. A* by Wheeler (1992) and is formally described here, along with *H. macfarlanei* R.L.Barrett and *H. thedae* R.L.Barrett, all endemic to basalt soils between the Mitchell Plateau and Theda Station. *Haemodorum capitatum* R.L.Barrett & Hopper is named from pindan sands around the Dampier Peninsula. *Haemodorum condensatum* Hopper & R.L.Barrett and *H. interrex* R.L.Barrett & M.D.Barrett are based on a small number of collections from the Prince Regent River area. *Haemodorum griseofuscum* R.L.Barrett, M.D.Barrett & Hopper is only known from a single location on Doongan Station in the north-west Kimberley. The genus has previously been reviewed for Australia by Macfarlane (1987), with 20 species recognised and for the Kimberley region by Wheeler (1992) who recognised five species in the region. However, both studies had limited material available and no opportunity for fieldwork in the Kimberley region.

Monographic studies by S.D. Hopper and colleagues have resulted in the resurrection (see APNI 2015) of *H. subvirens* F.Muell. described by Mueller (1858) and *H. flavescens* W.Fitzg. described by Fitzgerald (1918). *Haemodorum subvirens* is a new record for the Kimberley region (K.F. Kenneally 10993, PERTH and A.C. Beaglehole ACB 54058, MEL, PERTH), as is *H. coccineum* R.Br., which has been collected on El Questro Station (G. Byrne 3453, PERTH). Additional new species await description from the Northern Territory and Queensland. Further studies are particularly needed in the *H. flaviflorum* W.Fitzg., *H. gracile* T.Macfarlane and *H. parviflorum* Benth. species complexes in Western Australia, as it is likely that additional taxa should be recognised in each of these. There is a need for further research and collection of *Haemodorum* in the Kimberley before an adequate understanding of the genus is available.

The present paper highlights the Kimberley region of Western Australia as a major centre of diversity for *Haemodorum*, with 14 species now recognised there, almost half the species in the genus. At least seven of these are considered to be endemic to the Kimberley region, the remainder also occurring in the Northern Territory, and some extending to northern Queensland. Most tropical *Haemodorum* species flower early in the wet season when access is difficult and environmental conditions are challenging, limiting collection of good specimens. Targeted collections should be made at this time of year to assess regional variation in the more difficult species complexes. Geophytic species often respond quickly to breaking rains in tropical Australia and their diversity appears to have been overlooked in this region. *Haemodorum* is now the most species-rich geophyte genus known in the Kimberley region.

Methods

Descriptions and illustrations are based on herbarium material. All new species described here have been examined in the field by at least the first author.

Key to Kimberley *Haemodorum* species

Note: Two species are keyed both ways at step 3 due to the degree to which some leaves are flattened and extremes of width. Most specimens will readily key either way.

1. Inflorescence 5–10 cm tall, a compact raceme, much shorter than the leaves..... 2
- 1: Inflorescence (40–)60–175 cm tall, racemose, corymbose or paniculate, exceeding the leaves 3
2. Leaves terete to subterete; flowers blackish red; inflorescence dense **H. breviaule**
- 2: Leaves narrowly elliptic in transverse section and finely ribbed; flowers grey-brown; inflorescence not dense **H. griseofusum**
3. Leaves \pm flat in transverse section, (0.9–)1.8–8 mm wide..... 4
- 3: Leaves terete to subterete, usually 0.6–1.2 mm wide (rarely to 2.5 mm wide in *H. condensatum*) 12
4. Flowers yellowish green; leaves very bright green **H. subvirens**
- 4: Flowers brown, orange or red; leaves dark green to dull bluish green 5
5. Inflorescence with terminal flower clusters 1–few, capitate; leaves 0.9–2.5 mm wide **H. capitatum**
- 5: Inflorescence an open panicle of well-spaced flowers, or when dense, a raceme, \pm flat-topped corymb or series of corymbs; leaves (1–)1.8–8 mm wide 6
6. Flowers yellow-orange to dull orange; inflorescence an open corymb **H. basalticum**

- 6: Flowers bright orange-red to red to brown or aging to reddish (but bright orange-yellow to reddish in *H. macfarlanei*); inflorescence a dense corymb, open panicle or compound raceme. 7
- 7: Leaves flat or subterete, 1–3.3 mm wide; inflorescence a raceme or compound raceme; flowers yellow to bright orange-red to red 8
- 7: Leaves flat, 4–8 mm wide; inflorescence a dense corymb or open panicle; flowers dull red to orange-red to brown, red-brown or bright red 10
- 8: Leaves flat to subterete; flowers pale yellow when fresh, maturing red, densely packed on the inflorescence **H. condensatum**
- 8: Leaves flat; flowers bright orange to red when fresh, maintaining colour or becoming darker with age, well-spaced on the inflorescence 9
- 9: Leaves 0.6–0.8(–1.1) mm wide; flowers 4–5.5 mm long, bright yellow-orange to reddish, with a pair of subtending bracteoles **H. macfarlanei**
- 9: Leaves (1.6–)1.8–3.3 mm wide; flowers 5.2–7.1 mm long, brilliant orange-red to dark red, with a single subtending bracteole **H. thedae**
- 10: All flowers well-spaced along inflorescence branches; flowers dull red to orange-red to brown, often with dull green basal parts **H. ensifolium**
- 10: Flowers in close terminal clusters (dense panicle) on well-spaced inflorescence branches; flowers bright red to dark red-brown 11
- 11: Flowers bright red; anthers 2.0–2.4(–3.7 in Queensland) mm long **H. coccineum**
- 11: Flowers dark red-brown; anthers 2.6–3.5 mm long **H. interrex**
- 12: Leaves flat or subterete, 1–2.5 mm wide; flowers pale yellow when fresh, maturing red, densely packed on the inflorescence **H. condensatum**
- 12: Leaves ±terete (or flat to subterete in *H. macfarlanei*, but fresh flowers orange to red), 0.6–1(–1.2) mm wide; flowers yellow, greenish, orange or red, uniform in colour or darkening only slightly with maturity, well-spaced on inflorescence 13
- 13: Flowers greenish yellow or yellow; inflorescence racemose **H. flaviflorum s. lat.**
- 13: Flowers orange to red; inflorescence paniculate or few-branched and racemose 14
- 14: Inflorescence a flat-topped panicle; flowers red **H. gracile**
- 14: Inflorescence racemose, occasionally compound; flowers orange or red 15
- 15: Flowers yellow-orange to reddish; inflorescence (1–)3–5-branched; on basalt **H. macfarlanei**
- 15: Flowers red; inflorescence not or 1-branched; on sandstone **H. parviflorum (WA syntype)***

*One of the syntypes of *H. parviflorum* is a Cunningham collection from Western Australia. It is not considered conspecific with the Northern Territory syntypes, but typification of the name is required to establish its correct application.

Taxonomy

Haemodorum basalticum R.L.Barrett, Hopper & T.Macfarlane, *sp. nov.*

Type: Mitchell Plateau, Western Australia [precise locality withheld for conservation reasons], 25 January 2010, R.L. Barrett & M.D. Barrett RLB 6444 (*holo:* PERTH 08614334; *iso:* BRI, CANB, DNA, NSW).

Haemodorum sp. A, J.R. Wheeler in J.R. Wheeler (ed.), *Fl. Kimberley Reg.*, pp. 1014–1015, Figure 304E (1992).

Haemodorum sp. A Kimberley Flora (K.F. Kenneally 8639), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed 17 April 2014].

Illustration. J.R. Wheeler in J.R. Wheeler (ed.), *Fl. Kimberley Reg.*, p. 1013, Figure 304E (1992) [as *Haemodorum* sp. A].

Geophyte, 70–120 cm tall, with inflorescences exceeding the leaves; *bulb* 10–15 cm below soil surface, dark red. *Basal leaves* 2 or 3; lamina dark green, flat, 330–650 mm long, 2.2–4.3 mm wide. *Inflorescence* loosely corymbose, branching portion 150–570 mm long, with flowers clustered on short, slender axes for 5–15 mm, 3–9 flowers per unit, the flowers and bracteoles yellow-orange to dull orange. *Bracteoles* 1 in lower third to half of axis, 1 sessile or up to 0.9 mm below flower, narrowly ovate to elliptic, thin but not scarious, 1.6–2.5 mm long, only medial vein apparent, margins undifferentiated; upper bracteoles acute, extending up to one quarter of the flower length. *Flowers* 4.2–5.9 mm long; *pedicel* 2.0–5.0 mm long. *Sepals* narrowly triangular, obtuse, 3.6–5.2 mm long, slightly shorter than the petals. *Petals* linear, obtuse, 4.3–5.8 mm long. *Stamens* equal, level or slightly emergent from petals at anthesis by 0.6 mm; filaments 2.4–3.3 mm long, partially enclosed by petals when dry; anthers yellow-orange to almost white at anthesis, erect and held vertically, 1.6–1.9 mm long. *Style* at anthesis pale with darker apex, 4.3–4.8 mm long, emergent 0.3–0.6 mm from petals. *Fruits* chocolate brown to black, 3.7–5.7 mm long, 5.5–9.4 mm wide. *Seeds* black, circular in outline; body broadly ovate in outline, c. 2 mm wide; wing 0.5–1.2 mm wide. (Figure 1)

Diagnostic characters. *Leaves* flat, 2.2–4.3 mm wide. *Inflorescence* loosely corymbose, flowers clustered on short, slender axes for 5–15 mm. *Flowers* yellow-orange to dull orange. *Habitat* on basalt soils.

Specimens examined. WESTERN AUSTRALIA: [localities withheld for conservation reasons] 23 Apr. 1977, H. Eichler 22452 (CANB, DNA); 17 May 1978, K.F. Kenneally 6656 (MEL, PERTH); 7 Feb. 1979, K.F. Kenneally 7062 (CANB, CNS, DNA, PERTH); 6 Dec. 1982, K.F. Kenneally 8639 (CANB, CNS, PERTH).

Phenology. Flowering and fruiting recorded from December to February.

Distribution and habitat. Endemic to the north Kimberley of Western Australia, where it is known only from basalt soils over laterite or massive basalt sheets in the Mitchell Plateau to Theda Station area. Occurs in eucalypt woodland with *Terminalia fitzgeraldii* and *Livistona eastonii* as associated species.

Conservation status. *Haemodorum basalticum* is to be listed as Priority Two under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (A. Jones pers. comm.). Of restricted distribution on the Mitchell Plateau; probably more common in the area than collections suggest, but poorly known.

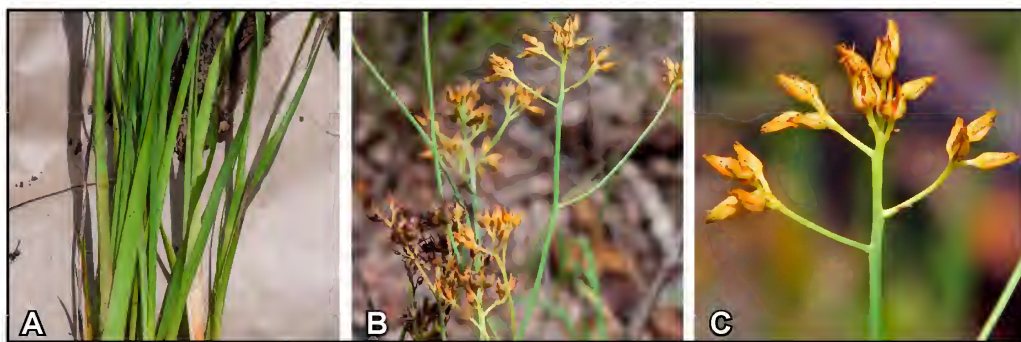


Figure 1. *Haemodorum basalticum*. A – flat leaves; B – yellow-orange flowers and developing red-brown fruits in the loosely corymbose inflorescence; C – close-up of flowers at apex of inflorescence. Images from R.L. Barrett & M.D. Barrett RLB 6444. Photographs by R.L. Barrett.

Etymology. Derived from the basalt substrate on which this species grows.

Notes. This is one of four species in the region known to occur on basaltic soils, the other three being *H. gracile*, *H. macfarlanei* and *H. thedae*. Most species are restricted to sandy soils. It is similar to *H. flaviflorum* in flower form, but is more like *H. ensifolium* in inflorescence structure, differing from both in having yellow-orange to orange flowers.

Haemodorum basalticum was first discovered by K.F. Kenneally in 1979, but it was not recognised as a distinct species until the treatment of Wheeler (1992). Recent collections have enabled it to be formally described here.

Haemodorum capitatum R.L.Barrett & Hopper, *sp. nov.*

Type: [north-east of Broome,] Western Australia [precise locality withheld for conservation reasons], 26 November 2013, R.L. Barrett & C. Bennison RLB 8315 (*holo:* PERTH 08614385; *iso:* BM, BRI, CANB, DNA, K, MEL, NSW).

Geophyte, 60–90 cm tall, with inflorescences exceeding the leaves; *bulb* 15–23 cm below soil surface, dark red. *Basal leaves* 1–3; lamina dark green, flat, 40–60 cm long, 0.9–2.5 mm wide. *Scape* to 90 cm tall, *bracts* broad, green, 25–62 mm long, 2.5–5.0 mm wide. *Inflorescence* very compact, flowering portion 45–180 mm long, forming a tight cluster of 1–few capitate heads on peduncles 3–17 mm long, flowers arranged very close together along the slender axes for 3–8 mm, 8–41 flowers per unit, the flowers and bracteoles maroon or dark red to scarlet. *Bracteoles* narrowly ovate to elliptic, thin but not scarious, 2.1–9.5 mm long, the 3 or 5 veins obscure abaxially, margins undifferentiated; upper bracteoles acute, extending up to half of the flower length. *Flowers* 3.1–4.3 mm long; *pedicel* 0.5–1 mm long (extending up to 4 mm long in fruit). *Sepals* narrowly triangular, obtuse, 3.7–4.2 mm long, slightly shorter than the petals. *Petals* linear to narrowly triangular, obtuse to acute, 4.5–5.2 mm long. *Stamens* equal, slightly emergent from petals at anthesis by 1 mm; *filaments* 1.8–2.7 mm long, enclosed by petals when dry; *anthers* pale yellow to orange-yellow at anthesis, erect and held vertically, shortly exserted from petals, *c.* 2 mm long. *Style* at anthesis red with maroon apex, entire or shortly bifid, 4.1–4.7 mm long, equal to or emergent to 0.7 mm from petals. *Fruits* dark chocolate brown, 6–7 mm long, 7–10 mm wide. *Seeds* not seen. (Figure 2)

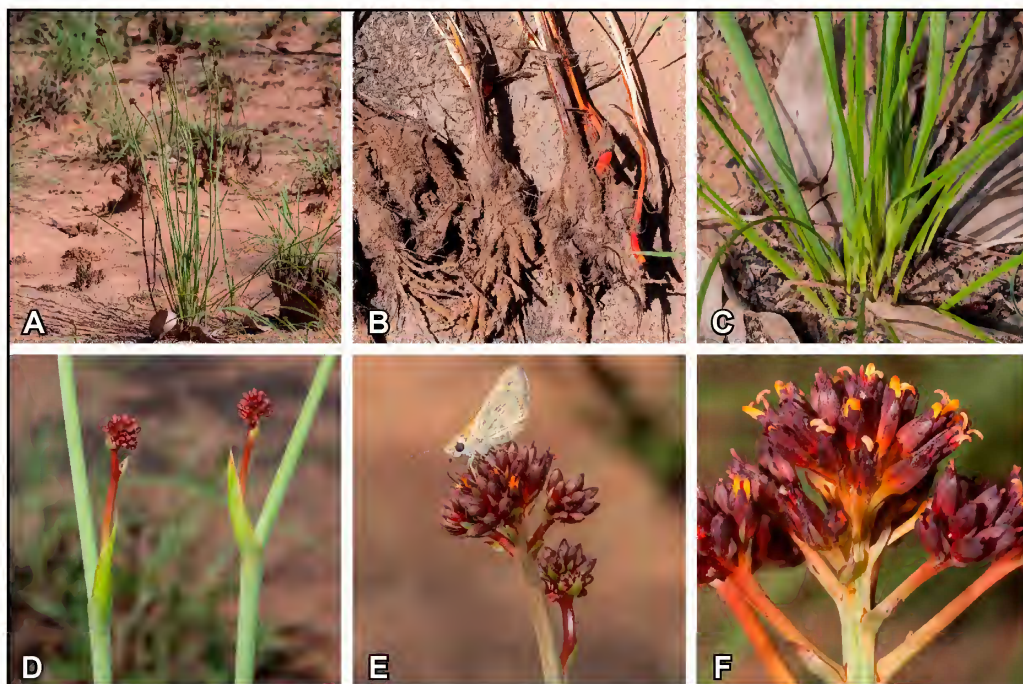


Figure 2. *Haemodorum capitatum*. A – habit, B – excavated bulbs, C – leaf and inflorescence bases, D – budding inflorescences and inflorescence bracts, E – compact inflorescence, F – flowers. Images from R.L. Barrett & C. Bennison RLB 8315. Photographs by R.L. Barrett.

Diagnostic characters. Leaves flat, 0.9–2.5 mm wide. Inflorescence a compact cluster of capitate heads. Flowers maroon or dark red to scarlet, sepal and petal apices obtuse.

Specimens examined. WESTERNAUSTRALIA: [localities withheld for conservation reasons] 22 Aug. 1985, K.F. Kenneally 9477 (CANB, PERTH); 24 Aug. 1985, K.F. Kenneally 9492 (NSW, PERTH); 18 Nov. 1984, T. Willing 155 (PERTH).

Phenology. Flowering recorded for August and November.

Distribution and habitat. Endemic to the south-west Kimberley of Western Australia, where it is known only from low depressions on pindan sand plains on grey and white sands. Associated species include *Corymbia polycarpa*, *Crotalaria crispata*, *Eucalyptus tectifera*, *Melaleuca acacioides*, *Terminalia canescens* and *Verticordia verticillata*.

Conservation status. *Haemodorum capitatum* is to be listed as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (A. Jones pers. comm.). Currently only known from four locations and not known from any conservation reserves.

Etymology. The epithet is from the Latin *capitus* (head) in reference to the very compact, head-like inflorescence structure.

Notes. The relationships of this distinctive species probably lie with *H. gracile*, which also has small red flowers with obtuse sepal and petal apices. The flat leaves and broad inflorescence bracts bear

some resemblance to *H. coccineum*, but that species has broader leaves and much larger flowers which have acute sepal and petal apices.

Haemodorum capitatum was first collected by T. Willing in 1984 and recognised as a distinct species by R.L. Barrett while conducting fieldwork supported by Buru Energy in 2013.

Further studies of *H. gracile* s. lat. are required, as the type collection is from basalt soils on the Mitchell Plateau, while all other collections are from sandstone habitats much further south.

***Haemodorum condensatum* Hopper & R.L. Barrett, sp. nov.**

Type: north of Bachsten Creek Falls, Prince Regent Nature Reserve [National Park], Western Australia [precise locality withheld for conservation reasons], 18 January 2010, *R.L. Barrett, M. Maier & P. Kendrick* RLB 6239 (*holo:* PERTH 08614628; *iso:* BRI, CANB, DNA, K, MEL).

Haemodorum sp. Gardner Plateau (R.L. Barrett & M.D. Barrett RLB 1008), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed 17 April 2014].

Geophyte, 50–75 cm tall, with inflorescences exceeding the leaves; *bulb* 7–8 cm below soil surface, scarlet. *Basal leaves* 4 or 5; lamina dark green, flat or subterete, to 30–60 cm long, 1–2.5 mm wide. *Inflorescence* a dense raceme or few-branched panicle with the ultimate branches racemose, 160–180 mm long, and single flowers distributed evenly along the slender axes for 25–65 mm, 14–36 flowers per unit, the flowers and bracteoles yellow when fresh, aging blackish red. *Bracteoles* acute, thin but not scarious, 2–3 mm long, the 3 veins obscure abaxially, margins undifferentiated; upper bracteoles acute, extending up to half of the flower length. *Flowers* 4–5 mm long; *pedicel* 1–2 mm. *Sepals* linear, acute, 3–3.5 mm, as long as petals. *Petals* linear, obtuse, 3–3.5 mm long. *Stamens* equal, level with to slightly emergent from petals at anthesis by c. 0.2 mm; *filaments* c. 1.5 mm long; *anthers* erect and held vertically, not prominently exerted from petals, 1.2–1.3 mm long. *Style* at anthesis 4.5–5 mm long, *emergent* 1–1.5 mm from petals. *Fruits* dark chocolate brown, 4–6 mm long, 6–9 mm wide. Immature *seeds* black, circular in outline; body broadly ovate in outline, c. 2.1 mm wide; wing not formed on immature seeds. (Figure 3)

Diagnostic characters. *Leaves* flat to subterete, 1–2.5 mm wide. *Inflorescence* with many flowers condensed in a tight raceme 25–65 mm long. *Flowers* yellow, aging blackish red.

Specimen examined. WESTERN AUSTRALIA: [locality withheld for conservation reasons] 4 Dec. 1994, *R.L. Barrett & M.D. Barrett* RLB 1008 (CANB, PERTH).

Phenology. Recorded for early December at the onset of the wet season and in late flower in mid-January. The first collection was from habitat that was not burnt the previous season.

Distribution and habitat. Endemic to the north Kimberley of Western Australia, where it is known only from two populations about 12 km apart in the southern Prince Regent National Park. Grows in open *Corymbia latifolia* woodland over *Triodia bitextura* on extensive sandstone flats below sandstone ridges. Associated species include *Calochilus caesioides*, *Haemodorum brevicaulis*, *H. gracile*, *Murdannia graminea*, *Sorghum plumosum*, *Tacca maculata* and *Terminalia ferdinandiana*.



Figure 3. *Haemodorum condensatum*. A – habitat at type location; B – habit; C – few-branched panicle with dense flowers and fruits. Images from R.L. Barrett, M. Maier & P. Kendrick RLB 6239. Photographs by R.L. Barrett.

Conservation status. *Haemodorum condensatum* is listed by Jones (2014) as Priority Two under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the name *Haemodorum* sp. Gardner Plateau (R.L. Barrett & M.D. Barrett RLB 1008).

Etymology. Named from the Latin *condensatus*, alluding to the condensed racemose inflorescences compared to those of *H. flaviflorum*, which have more widely-spaced flowers.

Notes. *Haemodorum condensatum* is a rare and poorly known species of the Kimberley. It is most similar to *H. flaviflorum*, from which it differs in its compressed leaves, its many flowers condensed in a tight raceme 25–65 mm long, and its flowers which age blackish red. *Haemodorum flaviflorum* was treated as *H. parviflorum* by Wheeler (1992) but the latter is a Northern Territory endemic.

Haemodorum condensatum was discovered by R.L. and M.D. Barrett while hiking near Bachsten Creek in 1994, then not relocated until targeted surveys were made nearby in 2010 by R.L. Barrett, M. Maier and P. Kendrick.

Haemodorum griseofuscum R.L.Barrett, M.D.Barrett & Hopper, *sp. nov.*

Type: cultivated: [at] Kings Park [and Botanic Garden, Perth, from material collected on Doongan Station], Western Australia [precise locality withheld for conservation reasons], 17 February 2013, M.D. Barrett MDB 4002 (*holo*: PERTH 08614350; *iso*: DNA).

Geophyte, 40–60 cm tall, with inflorescences greatly exceeded by leaves; *bulb* 6–10 cm below soil surface, dark red. *Basal leaves* 5–10; lamina dark green, compressed-ovoid in TS, finely ribbed, 30–60 cm long, (0.7–)1.0–2.2 mm wide (to 3.5 mm wide when fresh). **Inflorescence** very compact, an unbranched or once-branched raceme, 30–40 mm long, flowers distributed very close together along the robust axes for 15–20 mm, 14–18 flowers per inflorescence, the flowers and bracteoles grey-brown, tepals with dark brown to black apices. *Bracteoles* linear to narrowly elliptic, thin but not scarious, c. 6 mm long, the 3 veins obscure abaxially, margins undifferentiated; upper bracteoles acute, extending up to half of the flower length. *Flowers* 5–8 mm long, sessile above a pair of bracteoles with a *pedicel* 1.6–2.3 mm long below the bract. *Sepals* narrowly ovate, obtuse, 3.1–4.5 mm long, c. 1.5 mm shorter than the petals. *Petals* linear to narrowly oblong, obtuse, 4.5–7.0 mm long. *Stamens* equal, included within petals at anthesis; *filaments* 3.5–4.0 mm long, enclosed by petals when dry; *anthers* yellow-orange at anthesis, erect and held vertically, shorter than petals, c. 1.1 mm long. *Style* at anthesis red, 4.0–4.5 mm long, included by c. 0.8 mm from petals. *Fruits* not seen. *Seeds* not seen. (Figure 4)

Diagnostic characters. Leaves compressed, finely ribbed, (0.7–)1.0–2.2 mm wide when dry. *Inflorescence* very much shorter than the leaves, compact, forming a very dense raceme 30–40 mm long. *Flowers* grey-brown with dark brown to black apices, 5–8 mm long, sepal and petal apices obtuse.

Specimen examined. WESTERN AUSTRALIA: [locality withheld for conservation reasons] 17 May 2011, R.L. Barrett RLB 7233 (PERTH).

Phenology. Flowering not known in the field in Western Australia; cultivated material flowered in February.

Distribution and habitat. Possibly endemic to the north-west Kimberley of Western Australia, where it is known only from sand in *Eucalyptus miniata* and *E. tetradonta* woodland, growing with *Arthrostylis* aff. *aphylla*, *Commelina cyanea*, *Goodenia* sp., *Minuria macrorrhiza*, *Mitrasacme kenneallyi*, *Polycarpaea corymbosa*, *Stemodia lythrifolia* and *Vigna* sp.

Conservation status. *Haemodorum griseofuscum* is to be listed as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (A. Jones pers. comm.).

Etymology. The epithet is derived from the Latin *griseus* (grey) and *fuscus* (brown), in reference to the distinctive flower colour in this species.

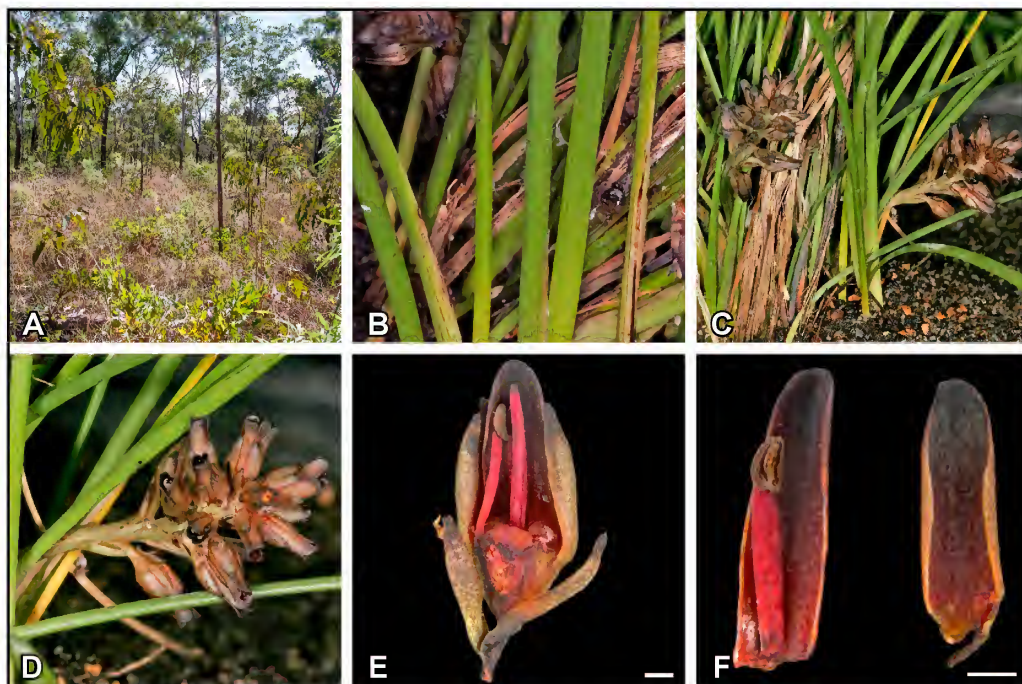


Figure 4. *Haemodorum griseofuscum*. A – habitat at type's original location; B – leaf bases; C – leaf bases and inflorescences; D – compact racemose inflorescence; E – partially dissected flower; F – tepals, staminal filament and old anther. Images from R.L. Barrett RLB 7233 (A) and M.D. Barrett MDB 4002 (B–F). Photographs by R.L. Barrett (A), M.D. Barrett (B–F).

Notes. The relationships of this distinctive species probably lie with *H. brevicaule* F.Muell., which also has a very short, almost sessile, but much more condensed and cylindrical inflorescence. The inflorescence and flowers of *H. griseofuscum* are larger, and the flowers are grey-brown with dark apices rather than entirely reddish black.

Haemodorum griseofuscum was discovered as sterile plants by R.L. Barrett during flora and fauna surveys coordinated by C. Myers on Doongan and Theda Stations in 2011. Live plants were collected which were cultivated, and subsequently flowered, at Kings Park.

There are somewhat similar collections to the Western Australian material from south-west of Darwin in the Northern Territory (*S.T. Blake* 16529, BRI; *G. Leach et al.* 4651, DNA), but further work is required to determine whether these collections belong to *H. griseofuscum* or represent a distinct species. Both of these Northern Territory specimens were collected in late November and were in fruit at that time. Habitat was similar to *H. griseofuscum* and populations occurred in sandy, pale brown loam and laterite in a *Eucalyptus miniata* and *E. tetradonta* woodland with *Acacia latescens*, *Cycas armstrongii* and *Livistona humilis*.

Haemodorum interrex R.L.Barrett & M.D.Barrett, *sp. nov.*

Type: north-north-west of Mount Agnes, West Kimberley, Western Australia [precise locality withheld for conservation reasons], 9 January 2001, *M.D. Barrett* MDB 1185 (*holo:* PERTH 07977611; *iso:* CANB, DNA, K).

Haemodorum sp. Prince Regent River (M.D. Barrett MDB 1185), Western Australian Herbarium, in *FloraBase*, <http://florabase.dpaw.wa.gov.au/> [accessed 17 April 2014].

Geophyte, 80–120 cm tall, with inflorescences exceeding the leaves; *bulb* 4–5 cm below soil surface, scarlet. *Basal leaves* 4 or 5; lamina dull green to bluish green, \pm glaucous, flat, 17–60 cm long, 4.5–8.1 mm wide. *Inflorescence* a few-branched panicle with the ultimate branches forming dense corymbs, 90–280 mm long, flowers crowded at the apex of moderately thick axes for 5–10 mm, 4–13 flowers per unit, the flowers and bracteoles dark red-brown. *Bracteoles* acute, relatively thick, not scarious, 5–8 mm long, the 1–5 veins obscure abaxially, margins undifferentiated; upper bracteoles acute, extending up to one quarter of the flower length. *Flowers* 5.5–8.0 mm long; *pedicel* 1.1–2.8 mm. *Sepals* lanceolate to narrowly ovate, acute, 4.5–5.5 mm, shorter than petals. *Petals* linear to oblanceolate, acute or obtuse, 5.3–6.3 mm long, enlarged up to 7.5 mm in fruit. *Stamens* equal, level with petals at anthesis; *filaments* 2.3–2.5 mm long; *anthers* erect and held vertically, not prominently exerted from petals, 2.6–3.5 mm long. *Style* at anthesis 3.8–5.2 mm long, emergent 0.5–1.8 mm from petals. *Fruits* dark chocolate brown to black, 6.0–7.5 mm long, 5.7–10.7 mm wide, often only 1 or 2 carpels maturing. *Seeds* black-brown, \pm circular in outline; body ovate in outline, 5.7–5.9 mm long, 3.5–3.7 mm wide; wing *c.* 0.8 mm wide. (Figure 5)

Diagnostic characters. *Leaves* flat, 4.5–8.1 mm wide. *Inflorescence* paniculate but with flowers in crowded clusters. *Flowers* dark red-brown, sepal and petal apices obtuse.

Specimens examined. WESTERNAUSTRALIA: [localities withheld for conservation reasons] 29 Jan. 2000, *M.D. Barrett* MDB 951 (CANB, DNA, K, PERTH); 2 Feb. 2000, *M.D. Barrett* MDB 1032 (CANB, DNA, K, PERTH); 12 Jan. 2001, *R.L. Barrett & M.D. Barrett* RLB 1770 (CANB, PERTH);

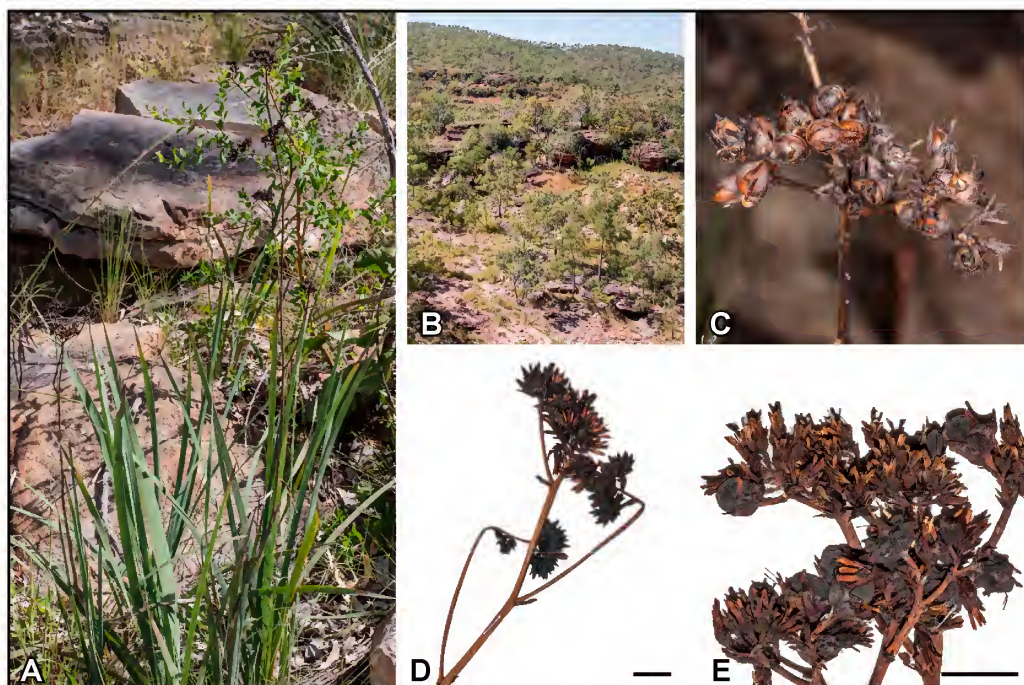


Figure 5. *Haemodorum interrex*. A—habit; B—habitat; C—few-branched paniculate infructescence; D—few-branched paniculate inflorescence; E—flowers in compact, corymbose clusters. Images from R.L. Barrett & M.D. Barrett RLB 4542 (A–C) and M.D. Barrett MDB 1185 (D, E). Scale bars = 1 cm. Photographs by R.L. Barrett.

19 Jan. 2003, R.L. Barrett & M.D. Barrett RLB 2588 (CANB, PERTH); 22 Apr. 2008, R.L. Barrett & M.D. Barrett RLB 4542 (PERTH); 13 June 1921, C.A. Gardner 874 (PERTH).

Phenology. Flowers and fruit recorded for January; probably fertile from December to March.

Distribution and habitat. *Haemodorum interrex* is only known from three populations near the headwaters of the Prince Regent River (all outside Prince Regent National Park) where it grows in open woodland on shallow sand over sandstone.

Conservation status. *Haemodorum interrex* is listed by Jones (2014) as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora, under the name *Haemodorum* sp. Prince Regent River (M.D. Barrett MDB 1185). All known populations are small and the total known range is only 20 km across. The species is possibly sensitive to frequent fires.

Etymology. The epithet is from the Latin *interrex* (a regent, temporary king), in reference to the location of this species in the Prince Regent River area.

Notes. First collected by C.A. Gardner on the W. Easton Expedition in 1921 (Gardner 1923), *H. interrex* was rediscovered and first recognised as a new species by M.D. Barrett during surveys of the remote Prince Regent River area in 1999. It appears to be most closely related to *H. subvirens*, differing in the dull green to bluish green leaves and red-brown flowers (leaves bright green and flowers yellowish green in *H. subvirens*).

Haemodorum macfarlanei R.L. Barrett, *sp. nov.*

Type: Mitchell Plateau, North Kimberley, Western Australia [precise locality withheld for conservation reasons], 7 December 1982, *K.F. Kenneally* 8661 (*holo*: PERTH 03079392; *iso*: CANB 534407).

Geophyte, 30–65 cm tall, with inflorescences exceeding the leaves; *bulb* 4–5 cm below soil surface, dark red. *Basal leaves* 5–10; lamina dark green, flat or occasionally almost subterete, 25–65 cm long, 0.6–0.8(–1.1) mm wide. *Inflorescence* a 1–5-branched compound raceme, the ultimate branches racemose, 90–250 mm long, with single flowers well-spaced at the base, becoming crowded at the apex of the slender axes for 40–80 mm, 7–18 flowers per unit, the flowers and bracteoles bright orange-yellow to reddish. *Bracteoles* narrowly ovate to elliptic, thin but not scarious, 2.0–2.6 mm long, the 3–5 veins obscure abaxially, margins undifferentiated; upper bracteoles acute, not overlapping or extending up to half of the flower length. *Flowers* 4–5.5 mm long, sessile above a pair of bracteoles with a *pedicel* 1.7–14.6 mm long below the bracteoles. *Sepals* linear to lanceolate, obtuse to acute, 3.4–4.1 mm long, about the same length or slightly shorter than the petals. *Petals* linear to oblanceolate, obtuse to acute, 3.4–4.1 mm long. *Stamens* equal, shorter than petals at anthesis by 0.5–0.8 mm; filaments 1.4–2.5 mm long, enclosed by petals when dry; anthers yellow-orange to almost white at anthesis, erect and held vertically, shorter than petals, 1.3–1.6 mm long. *Style* at anthesis pale with dark apex, 3.5–5.6 mm long, emergent 0.3–1.8 mm from petals. *Fruits* chocolate brown to black, 5–6 mm long, 4–9 mm wide. *Seeds* not seen. (Figure 6)

Diagnostic characters. *Leaves* subterete to flat, 0.6–0.8(–1.1) mm wide. *Inflorescence* a several-branched raceme, flowers crowded in upper 40–80 mm. *Flowers* bright orange-yellow to reddish, 4–5.5 mm long, sessile above a pair of bracteoles. *Habitat* on basalt soils.

Specimens examined. WESTERNAUSTRALIA: [localities withheld for conservation reasons] 24 Jan. 2010, *R.L. Barrett & M.D. Barrett* RLB 6376 (CANB, DNA, PERTH); 27 May 1991, *T. Willing* 437 (PERTH).

Phenology. Flowering recorded for December, January and May.

Distribution and habitat. Endemic to the north Kimberley of Western Australia, where it is known only from basalt soils over laterite or massive basalt sheets on the Mitchell Plateau, often in sandy loam in runoff areas. Associated species include *Acacia paula*, *Banksia dentata*, *Chrysopogon fallax*, *Eucalyptus latifolia*, *E. tetradonta*, *Livistona eastonii* and *Melaleuca nervosa*.

Conservation status. *Haemodorum macfarlanei* is to be listed as Priority Two under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (A. Jones pers. comm.). Of restricted distribution, with four populations known over a distance of about 50 km, in an area prospective for bauxite mining, but known to occur in the Camp Creek Conservation Reserve.

Etymology. The epithet recognises the work of Terry D. Macfarlane in revisionary work on *Haemodorum* and producing the *Flora of Australia* account of the genus (Macfarlane 1987).

Notes. One of four species in the region known to occur on basaltic soils, the other three being *H. basalticum*, *H. gracile* and *H. thedae*. It is like *H. flaviflorum* in inflorescence form, differing in having broader, flat leaves, and is also similar in inflorescence form to *H. thedae*, but differing in the more slender leaves, smaller, yellow-orange flowers and the pair of bracteoles subtending the flower

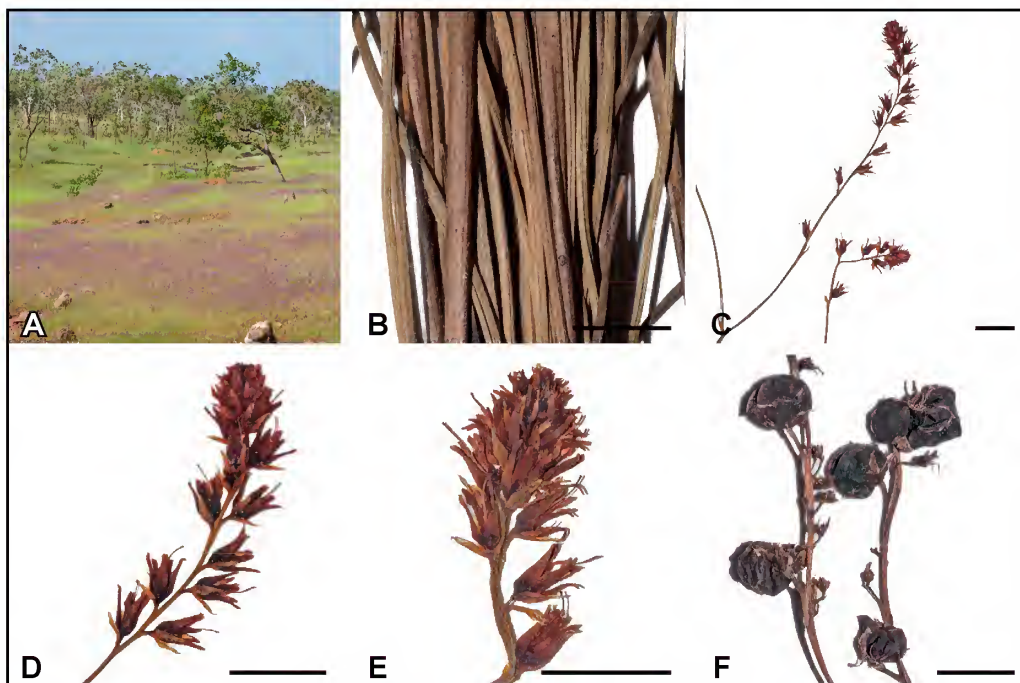


Figure 6. *Haemodorum macfarlanei*. A – habitat at type location; B – leaves; C – compound racemose inflorescence; D, E – racemose inflorescence showing floral bracts; F – racemose infructescence. Images from R.L. Barrett & M.D. Barrett RLB 6376 (A, F), T. Willing 437 (B–D) and K.F. Kenneally 8661 (E). Scale bars: B = 5 mm; C–F = 1 cm. Photographs by R.L. Barrett.

(vs 1 bracteole distantly subtending the flower in *H. thedae*). It is probably most closely related to *H. basalticum*, with which it occurs, but distinguished by a smaller stature and more slender leaves; also the inflorescence is a branching raceme rather than an open panicle.

Haemodorum macfarlanei was first discovered by K.F. Kenneally in 1982, but it was not recognised as a distinct species until a recent collection was made by R.L. and M.D. Barrett.

Haemodorum thedae* R.L.Barrett, *sp. nov.

Type: west-north-west of (new) Theda Homestead [Theda Station], North Kimberley, Western Australia [precise locality withheld for conservation reasons], 15 February 2005, M.D. Barrett MDB 1527 (*holo*: PERTH 08044163; *iso*: BRI, CANB, DNA, K, MEL).

Geophyte, 70–160 cm tall with inflorescences exceeding the leaves; *bulb* 8–9 cm below soil surface, dark red. *Basal leaves* 3–5; lamina dark green, flat, 48–81 cm long, (1.6–)1.8–3.3 mm wide. *Inflorescence* a compound raceme, 170–260 mm long, with individual flowers distributed evenly along the slender axes for 30–50 mm, 7–15(–25) flowers per unit, the flowers and bracteoles brilliant orange-red to dark red. *Bracteoles* narrowly ovate to elliptic, thin but not scarious, 1.5–3 mm long, the 3 veins obscure abaxially, margins undifferentiated; upper bracteoles acute, extending up to one third of the flower length. *Flowers* 5.2–7.1 mm long; *pedicel* 4.7–7.3 mm long. *Sepals* narrowly triangular, obtuse, 4.9–5.9 mm long, slightly shorter than the petals. *Petals* linear, obtuse, 5.2–6.7 mm long. *Stamens* equal, slightly emergent from petals at anthesis by 0.6 mm; filaments 2.6–4.5 mm long, enclosed by petals

when dry; anthers yellow-orange to almost white at anthesis, erect and held vertically, shortly exerted from petals, 1.5–1.8 mm long. *Style* at anthesis white with maroon apex, 4.6–6.1 mm long, emergent 0.8–1.5 mm from petals. *Fruits* chocolate brown to black, 5–6 mm long, 8–10 mm wide. *Seeds* black, circular in outline; body broadly ovate in outline, c. 3 mm wide; wing 0.5–1.5 mm wide. (Figure 7)

Diagnostic characters. *Leaves* flat, (1.6–)1.8–3.3 mm wide. *Inflorescence* a compound raceme, flowering portion 30–50 mm long. *Flowers* bright orange-red to dark red. *Habitat* on basalt soils.

Specimens examined. WESTERNAUSTRALIA [localities withheld for conservation reasons]: 21 Feb. 2005, M.D. Barrett MDB 1610 (AD, NSW, PERTH); 26 Aug. 2010, M.D. Barrett & R.L. Barrett MDB 3154 (NSW; PERTH).

Phenology. Flowering and fruiting recorded for February and observed to have finished by late March, but early flowering observed in August following an unseasonal rainfall event.

Distribution and habitat. Endemic to the north Kimberley of Western Australia, where it is known only from savannah woodland on basalt soils over massive basalt sheets in the Theda Station area. Associated species include *Corymbia greeniana*, *Eucalyptus tectifica*, *Livistona eastonii*, *Heteropogon contortus*, *Sorghum plumosum*, *Themeda triandra* and *Terminalia canescens*.

Conservation status. *Haemodorum thedae* is to be listed as Priority One under Department of Parks and Wildlife Conservation Codes for Western Australian Flora (A. Jones pers. comm.). Of restricted distribution with most of the known populations on roadsides or fence lines and thus subject to disturbance.

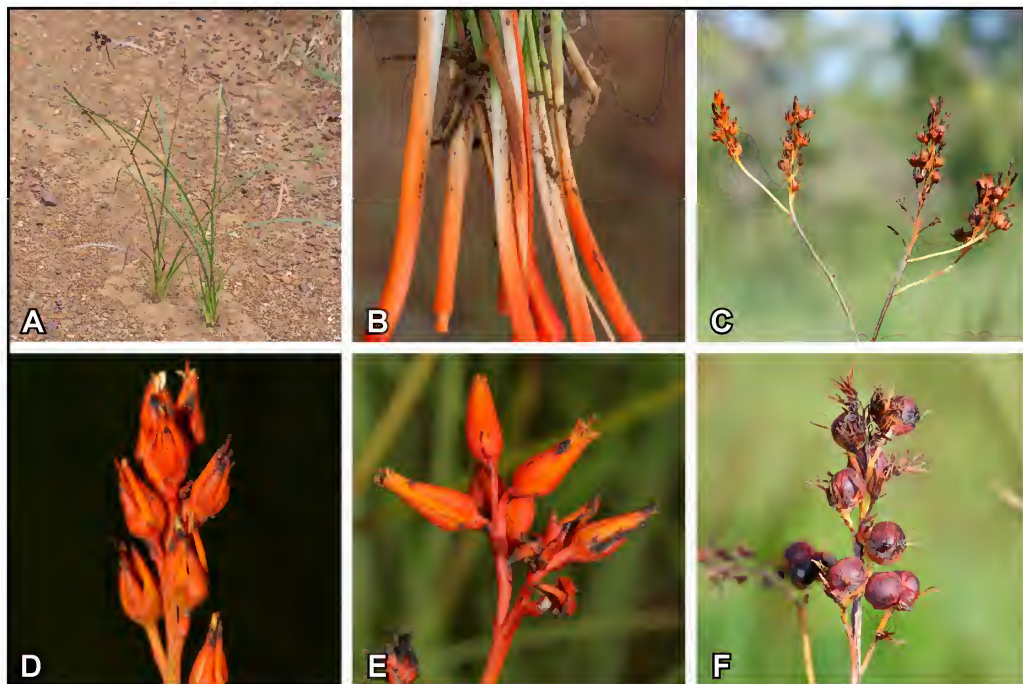


Figure 7. *Haemodorum thedae*. A – habit; B – stem bases; C – compound raceme with flowers and fruits; D, E – red flowers; F – fruits. Images from M.D. Barrett MDB 1610 (A, B, D) and M.D. Barrett MDB 1527 (C, E, F). Photographs by M.D. Barrett.

Etymology. The epithet is derived from Theda Station, on the Kalumburu Road, where this species is found. Theda Station was apparently named for Theda, the wife of the founder of the station lease, and this species is given a feminine epithet to reflect this.

Notes. This is one of four species in the region known to occur on basaltic soils, the other three being *H. basalticum*, *H. gracile* and *H. macfarlanei*. Most species are restricted to sandy soils. It is like *H. flaviflorum* in flower form and *H. macfarlanei* in inflorescence structure, differing from both in having broader, flat leaves. The compound raceme, large, orange-red to red flowers and moderately broad, flat leaves distinguish this species from all others in the region. Molecular data suggest that this species is most closely related to *H. basalticum*, which has a paniculate inflorescence and yellow-orange to dull orange flowers (R. Smith & S.D. Hopper in prep.).

Haemodorum thedae was first discovered by M.D. Barrett in 2005 during flora surveys on Theda Station

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References

- APNI (2015). *Australian Plant Name Index, IBIS database*. Centre for Biodiversity Research. <https://biodiversity.org.au/nsi/services/search> [accessed 10 March 2015].
- Fitzgerald, W.V. (1918). The botany of the Kimberleys, north-west Australia. *Journal and Proceedings of the Royal Society of Western Australia* 3: 102–224.
- Gardner, C.A. (1923). Botanical notes. Kimberley Division of Western Australia. *Forests Department Bulletin* 32: 1–106.
- Jones, A. (2014). *Threatened and Priority Flora list for Western Australia*. (Department of Parks and Wildlife: Kensington, Western Australia.)
- Macfarlane, T.D. (1987). *Haemodorum*. In: A.S. George (ed.) *Flora of Australia* 45: 134–148. (Australian Government Publishing Service: Canberra.)
- Mueller, F. von (1858). *Fragmenta Phytographiae Australiae*. Vol. 1. p. 63. (Government Printer: Melbourne.)
- Wheeler, J.R. (1992). Haemodoraceae. In: J.R. Wheeler (ed.) *Flora of the Kimberley region*. pp. 1012–1015. (Department of Conservation and Land Management: Perth.)